CODEO

Five Angels Limited -BVI

WHITE PAPER

ABSTRACT

Along with the success of bitcoin as a cryptocurrency and cryptographic technology with an open and transparent ledger which is borderless and non-governmental, it is attracting world attention and encouraging the growth of new developers who adopt blockchain technology with Dapp (decentralized application) where success and growth in blockchain technology and industry both users and applications also pose a new problem where the entire network system is increasing and loading on the network is very high.

But the development of this technology has not been accompanied by the understanding of users in adopting and using Blockchain as part of their daily lives. On the other hand there are a number of smartcontract platforms that boast of speed and accuracy by declaring high transactions with shorter and faster transaction times.

Codeo Network system comes with an innovation and provides a solution to the problem of scalability and becomes a solution in scaling off / side chains for platforms used by users.

Having Ethereum as the first platform was the best choice by the CODEO development team where Ethereum was able to demonstrate scalability and implementation through the Kovan testnet.

In accordance with the Vision of the CODEO development team that the implementation and adaptation of the system framework uses Plasma to ethereum in the hope of enabling instant transfer, exchange and conversion of digital assets and cryptocurrency to be better in the future.

CODEO builds a system ideology pillar by providing off / side chain scaling solutions for blockchain which will not only be used by users but allows developers to design and implement and migrate all Dapps based on ethereum both wallet, API, wallet and SDK.

CODEO

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CODEO

Why CODEO?

The development and growth of technology from the blockchain is increasing rapidly, but it is not matched by the readiness of the blockchain ecosystem that is able to make adjustments to the demand for end user applications with the concept of mass adoption. at this time the intended conditions are very bad and all developers separately build applications and systems by showing their uniqueness without regard to the ecosystem itself

The following section will provide an overview as well as an explanation of how CODEO NETWORK is present to provide solutions and resolve the problems currently faced, by attaching detailed technical specifications which can be seen in the next section in the whitepaper

Scalability

Theoretically, the CODEO NETWORK system has the capacity for millions of transactions per second with the use of sharing sidechains where the speed reaches 20,113 transactions per second in one side of a single chain.

The CODEO development team is currently trying to improve the capacity and capability of CODEO in adding more transaction chains that will later use PoS (Proof of Stake)

Low Transaction Throughput

Main net or Public blockchains have to maintain a certain amount of time lag between the production of adjacent blocks so as to ensure ample time for block propagation. Also, the block size needs to be small so as to ensure quick propagation of the block through the CNETWORK system. This entails that the number of transactions in a particular block need to be fairly limited.

The CODEO CNETWORK system solves this problem by using a Block Producer layer to produce the blocks. Block Producers enable the system to produce blocks at a very fast rate. The system ensures decentralization using PoS checkpoints which are pushed to the Mainchain (Ethereum serves as the mainchain for a start).This enables The CODEO CNETWORK system to theoretically achieve up to 216216 transactions per second on a single side chain.

Slow Transactions

Blockchain transactions are typically very slow and have a very limited throughput. Most PoW (Proof-of-Work) based blockchain protocols have a limit on the block size and it takes a certain amount of time to generate a block. Each transaction also has to wait for multiple block confirmations due to potential chain re-organizations.

PoS (Proof-of-Stake) based blockchains try to counter these limitations using a staking mechanism, but the blockchains that are able to achieve high throughput with PoS are able to do so at the cost of decentralization. These limitations are often a necessary condition for public blockchains to ensure security and decentralization where a block needs to be propagated through the CNETWORK system and validated by all the nodes to achieve finality.

The CODEO CNETWORK system solves this problem by using a high throughput blockchain with consensus provided by a selected set of Block Producers, chosen for every checkpoint by a set of Stakers. It then uses a Proof Of Stake layer to validate the blocks and publish periodic proofs (merkle roots) of the blocks produced by the Block Producers to the Ethereum mainchain. This helps in achieving high level of decentralization while maintaining an extremely fast (< 2 seconds) block confirmation times.

Multiple micropayment channels with other off-chain solutions

Some payment channel solutions have proposed solutions to solve the problem of micro-payments. However, the process of opening and managing channels with multiple DApps or users is complex. Additionally, the speed and convenience of mediated payments over channels is still up for debate.

Since The CODEO CNETWORK system uses a state-based architecture on an EVM (Ethereum Virtual Machine), it does not require payment channels to be opened between two parties. In fact, any valid Ethereum address is a valid CODEO Address and a receiver does not need to be on the CODEO chain to receive payment. They would only need to have a CODEO Wallet when they want to retrieve the payments on the main chain or spend it in the ecosystem on the CODEO CNETWORK system.

Size of Blockchain

Each block on the blockchain and/or compute state in case of a smart contract based blockchain must be validated by multiple nodes. Each node has to manage a copy of the state and the blocks. While the chain increases in size as the days go by, maintaining and validating the whole blockchain becomes difficult and results in fewer full nodes in public blockchains, which poses a risk for decentralization.

For the CODEO CNETWORK system, the primary layer which provides decentralization may choose to store only the blocks of CODEO Chain from the previous checkpoint to the next checkpoint. All previous transaction/block proofs have been submitted to the mainchain. This enables extremely low fidelity PoS nodes which can be run in very low-cost machines with low storage. In future, The CODEO CNETWORK system intends to enable mobile device based PoS miners too.

Poor Usability

User interactions on DApps are often poor compared to their centralized counterparts. For the Decentralization revolution to achieve mass adoption, the user experience of DApps has to be on par with, if not better than, their centralized counterparts.

The CODEO Development team is expected to work on various Mobile and Web browser integration tools and is pioneering protocols in this domain. It intends to build a ubiquitous mobile/browser app, which will act as a secured interaction layer for blockchain interactions. The CODEO Development team will be publishing the designs and prototypes of these soon.

High Transaction Fees

With the rapid growth of the blockchain ecosystem, new crypto assets are increasingly being created, transferred, and sold, often involving multiple crypto tokens. Also, most decentralized apps have their own token and economy. Paying tokens for the services or doing any kind of transaction on blockchains requires on-chain transfers. Every blockchain has a transaction cost structure. For example, Ethereum charges gas fees on each transaction.

The amount of fees is an important factor to incentivize validators and prevent certain kinds of security attacks such as DoS. However, there is the problem of variation of fees (Depending upon the pending transaction pool) due to the limited block size.

The CODEO CNETWORK system enables low cost transactions through achieving economies of scale by doing a large number of transactions on the Block Producer layer which ensures low cost, and then subsequently batching the proofs of the CODEO blocks using the Merkle root of the blocks to a highly decentralized mainchain (for ex. Ethereum) using a decentralized layer of PoS Stakers.

Introducing the CODEO CNETWORK

As discussed in brief in the section above, the CODEO CNETWORK aims to solve the problems faced by the blockchain ecosystem through building a decentralized platform using an adapted version of Plasma framework. This provides for fast and extremely low cost transactions with finality on a mainchain. The current working Testnet and alpha-Mainnet of the CODEO CNETWORK works with Ethereum as a mainchain.

The CODEO Development team is also building a product ecosystem including user friendly mobile apps, desktop wallets and browser extensions which will provide a seamless experience for all users. It is envisaged that users will be able to pay, transfer or hold crypto assets without worrying about the complexity of the underlying system.

Architecture

Since the CODEO CNETWORK's core focus is on mass user adoption, it is ideal that a deep dive into the CODEO CNETWORK's technical architecture should start from a user journey.

When a user is transferring ETH or ERC20 tokens on the Ethereum CNETWORK, they have to wait for the confirmation of the block which ranges from 14 seconds to 20 seconds. Even then the users have to wait for multiple block confirmations to be sure of the finality of the transaction. Let’s say you are buying a coffee or paying tokens to watch a movie. On each transaction you are not only paying a high fee, but also waiting for it to be confirmed. That serves as a deterrent for users wanting to use the service.

Moreover, during peak loads, a large number of transactions clog the Ethereum CNETWORK and gas fees increase on each transaction in order to obtain faster confirmations. The CODEO CNETWORK is proposed as a solution to overcome these problems.

Here is how the CODEO CNETWORK will function:

1. A user deposits a cryptographic asset in the CODEO contract on the mainchain (currently implemented with Ethereum blockchain only).

2. Once deposited, tokens get confirmed on the main chain, tokens will appear on the CODEO Chain using CODEO Deposit bridge (technical details explained in a dedicated section below).

3. The user can now transfer tokens to anyone they want almost instantly (CODEO Chain has faster blocks - approximately 1 second or less) for almost negligible fees.

4. Whenever the user wishes to, they can withdraw tokens to the main Ethereum chain by establishing proof of remaining tokens on Root contract (contract deployed on Ethereum chain)

Actors

The ecosystem of The CODEO CNETWORK will have the following actors :

1. End Users

2. DApp developers : Developers are expected to use the CODEO CNETWORK to scale their applications and provide a better UI/UX to their end users

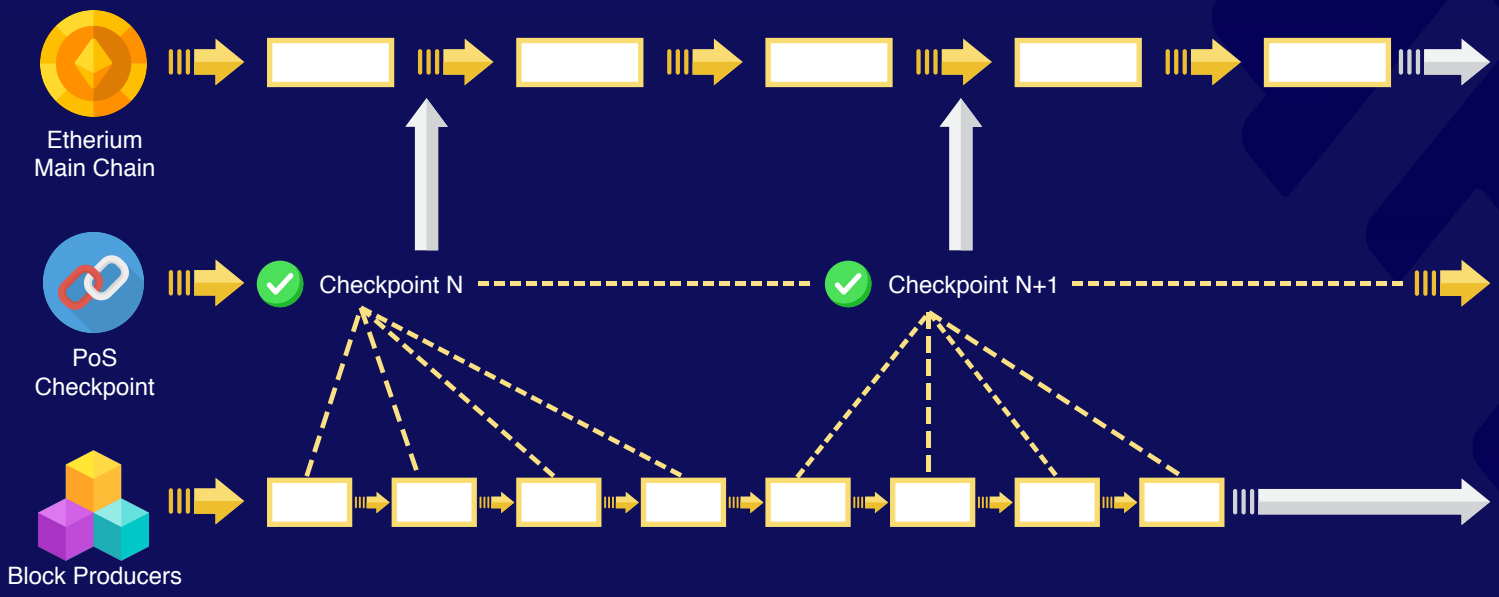
3. Stakers : Stakers need to deposit/stake tokens to qualify and play a very important role in the CODEO CNETWORK. They validate the transactions and propose checkpoints on the mainchain using PoS consensus mechanism with a majority. They also choose Block Producers amongst themselves, who satisfy a certain criteria, to produce blocks on the sidechains.

4. Block Producers : These are block producers chosen by Stakers who in turn enable faster blockchain generation times. They have to provide a significant stake to be nominated.

Consensus

The CODEO CNETWORK uses a dual strategy of Proof of Stake at the checkpointing layer and Block Producers at the block producer layer to achieve faster blocktimes while ensuring a high degree of decentralization by achieving finality on the main chains using the checkpoints and fraud proof mechanisms.

CODEO Chain



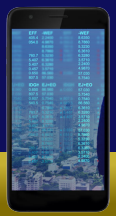
Through this mechanism, The CODEO CNETWORK achieves high transcation speed with a high degree of decentralization and finality on Mainchain. In the first version which has Ethereum only as the base chain, Ethereum root contract enforces solvency and finality through header block(checkpoints) very efficiently. The various elements and mechanisms of the system are described below:

Checkpointing Layer

Basically, anyone can stake their CODEO Tokens on root contract to become a Staker in the PoS checkpointing layer (contract deployed on Ethereum chain). This provides a highly decentralized base layer for CODEO Chain.

Block Producers

At the blockchain layer of the CODEO CNETWORK, there are Block Producers, selected by PoS Stakers on the base layer, who will be creating the CODEO Blocks. To achieve faster block generation times, these Block Producers will be low in number. This layer is expected to achieve ~1 second block generation times at extremely low to negligible transaction fees.



Checkpointing Mechanism

On CODEO CNETWORK's checkpointing layer, the basis of CODEO CNETWORK's PoS mechanism, for every few blocks on the block layer of the CODEO CNETWORK, a proposer will be chosen among the stakeholders to propose a checkpoint on the main chain. These checkpoints are created by the proposer after validating all the blocks on the block layer of the CODEO CNETWORK and creating the Merkle tree of the block hashes since the last checkpoint. The Merkle root is then broadcasted to the Staker CNETWORK for their signatures. The other stakeholders also verify the proof. They will approve the proposed block, if it is valid, by providing their signatures.

The system needs the approval of of the stakeholders to propose a "header block" to the root contract. Once the checkpoint is proposed on the mainchain, anyone on the Ethereum mainchain can challenge the proposed checkpoint within a specified period of time. If no one challenges it and the challenge period ends, the checkpoint is formally included as a valid checkpoint on the main chain.

Apart from providing finality on the mainchain, Checkpoints have a very important role to play in withdrawals as they contain the proof-of-burn (withdrawal) of tokens in the event of user withdrawal. It enables the users to prove their remaining tokens on root contract using Patricia Merkle proof and header block proof. Note that to prove remaining tokens, the header block must be committed to the Root Chain through PoS (Stakeholders). The withdrawal process will incur Ethereum gas fees as usual.

Through this mechanism, The CODEO CNETWORK achieves a high transaction speed, a high degree of decentralization and finality on Mainchain. In its first version which has Ethereum as the base chain, the Ethereum root contract enforces solvency and finality through header blocks (checkpoints) very efficiently.

Block Producer Selection

Block Producers are chosen by Stakers in the checkpointing layer through voting on the mainchain. A Block Producer is selected for a pre-determined interval of time until slashed/removed by the CNETWORK consensus mechanism or if it is unable to participate in the block production due to any external issue.

Seeding of the CNETWORK

1. CODEO CNETWORK will ask for applications from the public to run the Block Producer nodes
2. It will also run 3 Block Producer nodes itself during the seed stage of the CNETWORK
3. At the epoch, the public stakers will select a total of 5-7 block producer nodes
4. These nodes will be kickstarted with a CODEO Chain N(number of) genesis configuration

Block Producer Application Process

1. The Block Producers have to apply by staking the Block Producer Stake requirement amount in CODEO Tokens on the mainchain
2. The CNETWORK will maintain a pool of interested Block Producers (An incentive system for the Block Producer nominees would be devised to keep ample number of Block Producers in the pipeline)

Criteria on the basis on which Stakers will decide to vote for a particular nominee Block Producer are as follows:

- Uptime history
- Technical specifications
- Dynamic scaling capability
- Location diversity
- Other factors under consideration (e.g. [Zcash Board Nominations](https://github.com/ZcashFoundation/Elections/blob/master/2018-Q2/Board-Nominations/Sokolov_selfnomination.md))

Selection Through Voting at Tenure Completion

1. Voting process is scheduled and completed one week before the completion of one tenure
2. Existing Block Producers can re-appear in the elections
3. Stakers vote for Block Producers from the pool of Nominees

Replacement of a Block Producer during the ongoing tenure

In an event of untimely removal/incapability of a Block Producer to take part in block production, a new Block Producer from the transient pool will be recruited. An appropriate incentive mechanism to have a prioritized/preferred list of Block Producers as per the stakers' vote will be devised to maintain a healthy pool of Block Producers.

Multi Chain Support (Horizontal Sharding)

The CODEO CNETWORK public checkpointing layer supports multiple side chains by design. Theoretically there can be an infinite number of side chains working under the secured and decentralized layer of checkpoints. Businesses can have their dedicated side chains connected to the public checkpointing layer having full control of their execution environments, while still retaining the immutability, provability and security of transactions via the checkpointing mechanism.

Key factors influencing design of this sharding process are expected to be:

1. Scheduling of checkpointing layer to periodically propose checkpoints for different side chains
2. Movement of assets across multiple side chains
    - o User will be able to send assets across side chains using chain ids and receipts
    - o Users will be provided with an intuitive wallet interface to perform inter-chain transactions
    - o Developers will be provided with API/SDKs to build programmable interfaces for inter-chain transactions.
3. Movement of the assets from one chain to another will be managed at the checkpointing layer and may not require any interaction with the mainchain. Research is currently underway to facilitate faster (possibly instant) inter sidechain transfers.

Interoperability

As mentioned earlier in the whitepaper, the Ethereum mainchain is the first base/mainchain that CODEO CNETWORK securely integrates with, using an adapted implementation of the Plasma framework. In addition, the CODEO CNETWORK intends to integrate multiple leading smart contract platforms cryptocurrencies such as Bitcoin and others to provide an universal platform for the users to be able to use/exchange their assets from various blockchains.

It can also provide a strong foundation for large DEXs (Decentralized exchanges) hosting assets from multiple blockchains. Also having a single platform with assets from multiple blockchains can also give rise to draCODEOally new use-cases, which the developer ecosystems can conceptualize their future products on. It is an exciting area of exploration for the CODEO Development team.

Judging from the proliferation of Layer 1 blockchains, it is a given that there might be more than 2-3 public blockchains that will be adopted by the mainstream eventually, rather than only a single winning blockchain platform. Therefore, the CODEO Development Team expects to see hitherto unseen use-cases, arising from the Decentralized application movement across these blockchains. The vision of the CODEO Development Team is to provide infrastructure and interfaces such that anyone who wishes to build decentralized applications on any blockchain, will be able to do it easily - and communicate and transfer value across multiple blockchains.

Generalized State Scaling on Plasma

Generalized State scaling is the next frontier for the CODEO CNETWORK, once the CODEO Development Team is done with implementing micropayments, asset transfers and swaps in the first phase of development of the CODEO CNETWORK. This is a research problem, and it will take time and effort to accomplish a breakthrough here.

There are mainly 3 different approaches that the team has been researching on:

- Stateful object programming model (separating code and state)
- State transition verification through zk-snarks
- State transition verification using an EVM-in-an-EVM construction

One of the main approaches that the CODEO Development Team has been researching on is the Stateful object programming model for Plasma. The main problem with applying the Plasma model to contracts on a sidechain is of the "ownership" of states/assets on the sidechain. One fundamental property of Plasma is that state represented on a Plasma chain must be able to be withdrawn to the root chain (e.g. Ethereum) in a way that maintains the integrity of that state. You should be able to freely move assets/state from the Plasma chain to the root chain, and vice versa. This functionality is particularly important when a consensus mechanism on the sidechain goes “bad” and users are forced to withdraw their assets/states from the Plasma chain.

States/assets belonging to a user (Externally Owned Accounts) are easy to deposit/enter and withdraw/exit from the mainchain to the sidechain and vice versa. However, in terms of contracts, it is not easy to identify the ownership of the state - because the state might be owned/controlled by multiple parties. The most promising approach to solving this problem is basically separating state and code.

What this approach entails is to enable writing code which reads/writes into "stateful" objects. Stateful objects are representation of states which have a clear owner. For example, a contract has a set of states controlled by n parties, then stateful objects will be derived by encapsulating state into non-fungible tokens having clear ownership - this way a stateful programing model is introduced that enables these objects to be exitable and therefore Plasma-ficable.

The second approach entails the usage of zk-snarks for verifying state transitions for a sidechain. Basically one could operate a roll-up style chain, which can perform any state transitions, and a zk-proof can be submitted.

A valid state transition is proven within the snark by opening one or several leaves of the merkle tree describing the current state, checking the user's signatures, doing predefined operations, updating the leaf and finally recalculating the stateRootHash. DApp-specific roll-up style chains on the plasma chain can allow developers to have secure, high-throughput DApps without worrying about liveliness, data-availability issues or withdraw issues. We can store any information we want in merkle leaves of the trees and write the snark logic on how they should be updated, since invalid snark proofs cannot be pushed and so it's inherently secure and simple. We are actively researching on this area and trying to come up with a secure and scalable construction.

The third approach involves a Plasma sidechain implementation that can run EVM-compatible smart contracts - i.e. the CODEO Virtual Machine. Since the philosophy of the CODEO CNETWORK heavily revolves around an incentive mechanism of security deposits on the main chain, it can be instructive to think about an efficient way of identifying the data involved in fraud challenges.

Validation of consensus rules can be enforced through a system of challenges, using a TrueBit-like verification. The main motivation is to run software in a similar manner as we currently do on the Ethereum mainchain. The security deposit makes it easier to estimate the security of the sidechain in monetary terms. When working correctly, the stakers will frequently commit the sidechain blocks to the root chain.

A set of validations is expected to keep the stakers honest. There are a number of insurance contracts incentivizing the verification of the chain. Together these contracts combined would make for a complete set of consensus validation rules on the root blockchain. Such rules include:

- Withholding challenges: The Block Producers might have submitted blocks to the blockchain but have withheld the contents. The stakers must present a preimage or risk getting slashed.
- Parsing challenges: The Block Producers submitted an invalid block structure.
- Transaction censorship: Submit a transaction on the root chain, requesting for it to be included
in the sidechain within a certain timeframe.
- Invalid block signature: The stakers provided an invalid signature of the block.
- Invalid previous block hash, height, or previous state, among other block verifications.
- Any other consensus failure checks, like transaction receipts posting an invalid after state.
- Invalid transaction execution: an on-chain way to verify a transaction.

The last step is the most complex technically, but using a Truebit-like binary search, there would only be a need to verify one EVM state transition

A precompile is required to run the EVM inside an EVM. This is done through a stepper contract that can compute a EVM state transition.

Some work on this already started (see solevm), but the focus will be to correctly encode the whole EVM state in such a way that it can fit inside a transaction in the root chain, for the purposes of verifying it with an interactive Truebit game. The CODEO Development Team believes that a large security deposit, plus other economic interests that participants might have in the correct operation of the side-chain, would lead to less risks.

Overall, if one can efficiently identify the probleCODEO EVM state transition for verification, through an EVM-in-an-EVM construction, one can subject it to challenges, and thereby securing it.

Security

Fraud Proofs

To enhance the security of the transactions, CODEO CNETWORK also provides Fraud Proofs on the mainchain. The mechanism enables any individual on the mainchain to submit the details of the transactions which he/she thinks is fraudulent. If the challenge is successful, the stakes of the parties involved in the fraud are slashed and the challenger receives the slashed funds as an incentive for detecting the fraud. This can be considered as an always-running high reward bounty program for any parties who wish to investigate the veracity of the transactions on the CODEO CNETWORK.

Basic proofs

Each proof must be submitted with the following corresponding proofs whenever necessary:

- Merkle proof for transaction inclusion: This type of proof is needed to prove that the given transaction is included in the block
- Merkle proof for block inclusion: This type of proof is needed to prove that the block is included in the given checkpoint.

Block

This proof is needed to prove that the block is in sequence with a valid referenced hash.

Transaction

Single level txn proof

```
// validate ERC20 TX
   function validateERC20TransferTx(
     uint256 headerNumber,
     bytes headerProof,

     uint256 blockNumber,
     uint256 blockTime,
     bytes32 txRoot,
     bytes32 receiptRoot,
```

```
    bytes path,
    bytes txBytes,
    bytes txProof,
    bytes receiptBytes,
    bytes receiptProof
  ) public {
    // validate tx receipt existence
  }
```

Nonce validation

- To check if there are transactions with duplicate nonces
- To check for transactions with missing nonce values (skipping multiple nonces in between)

This is an interactive fraud proof. The Block Producer must submit missing nonce transaction in certain amount of time when challenged for this type of transaction.

- To check for transactions with non-ordered nonces

```
function validateMisMatchedNonce(
  bytes tx1,
  bytes tx2
) public {
  // check if both transactions are not the same
  ...

  // validate first transaction
  ...

  // validate second transaction
  ...

  // check if sender is the same in both transactions
  ...

  // make sure 2 is included after tx1
  ...

  // check if both nonce values are same or nonce2 < nonce1, just call
    slasher
  ...

  // revert the operation
  ...
}
```

Receipt validation

- To check receipt fields, events, topics and data types in given receipt

Deposit

- Validate deposit transactions Validates deposit transaction on the mainchain and see if it matches with DepositBlock object in rootchain.
- Duplicate deposit transactions This proof validates if there are duplicate transactions that have the same DepositId and that each DepositID is included only once
- Validate deposited amount and the depositor address

ERC20 transfer

- To validate ERC20 transaction data, receipt logs and values
- To check if UTXO-style input in log receipt log equals that of an UTXO-style output of a recent transaction log receipt

Iterative txn proof

Details to be updated in a later version of the whitepaper

CNETWORK Economics

Transaction Fee Determinative Factors and Trade-off

1. Block Size = (Average Transaction Amount)/(Block)
   - o 100Txs/Block is insanely expensive.
   - o ETH is 600~1000Txs/Block
   - o If The CODEO CNETWORK permits 3000Txs/Block, this variable is going to be the predominant factor over other factors.
2. Number of Block Producers
   - o If there are more Block Producers, transaction fee allocation will be more.
   - o Block Producer setting of 7 is cost efficient.
   - o If the number of Block Producers is increased to say, 120, the transaction fee increases.
3. Number of Checkpoint stakers
   - o If number of stakers is 10,000, then it will be expensive to structure incentives.
   - o 100-150 stakers will result in an optimum transaction fee.
   - o Having fewer stakers than this is better, but decentralization in such a setup is lower.
4. Block Time
   - o The CODEO Development team could assign 2~3sec for block time.
   - o 0.5sec block time still works with regards to block propagation, and it has no effect on user experience.

- Let's say, a single CODEO sidechain aims to achieve ~35k Tx/sec on a chain. If node through-put is the bottleneck, then blocksize would be 70k~105k Tx/Block.

5. Checkpoint duration
   - A checkpoint duration of ~300sec (256 blocks on sidechain) has been determined to be optimum.
   - A shorter duration means faster Maliciousness detection, but it also means a higher committed Gas fee.
   - If a Byzantine behavior (e.g. Double Spend through Tx deletion) occurs just after checkpoint creation, this duration is the worst-case time until the Ceremony. If some Block Producers delete transactions, the CODEO CNETWORK can recover the cancelled transaction, and the double spend attack would be foiled.

Focus on User Experience

The CODEO Development Team is developing a wallet by implementing the WalletConnect protocol, which is an open protocol to connect web-based distributed applications to mobile crypto assets.
This wallet will help users to interact with DApps and sign transactions easily, while still helping users keep their private keys safe on their mobile. This should go a long way in making blockchains accessible to mainstream users.

Other than this, the team is also looking at context specific ether-less accounts and Gas relay abstraction on identity to enable ether-less sign transactions, which can be a huge boost for mainstream user adoption.

CODEO Stack

This section details out various parts of the CODEO chain and components in the Ethereum chain.
CODEO contracts on mainchain

The CODEO smart contracts on the mainchain provide the core logic for the CODEO CNETWORK. The contracts contain various mechanisms such as deposit and exits from the mainchain to the sidechain and vice versa. They also contain the exit priority queue, the periodic state commitments from the Validator layer, fraud proof mechanisms, bonded exit challenge logic and various other components. The Stake Manager also resides here.

CODEO PoS

The checkpointing mechanism of the CODEO CNETWORK is a PoS enabled layer which has Stakers who propose the checkpoints to the mainchain. There will be about 100-150 Stakers at the checkpointing layer to start with. In future with the advent of more efficient signature mechanisms on the Ethereum blockchain, the CODEO CNETWORK will be able to significantly increase its number of stakers on the checkpointing layer which is expected to further increase its degree of decentralization, perhaps rivalling that of the leading public blockchains like Ethereum and Bitcoin.

More details of the PoS checkpoint layers will be given in a later version of the Whitepaper.

Block Producer Layer

At the base layer, the CODEO CNETWORK has Block Producer nodes chosen by the Stakers of the PoS layer through voting for every checkpointing interval. These Block Producers will also run the CODEO Deposit bridge.

Block Producers accept transactions through the CODEO VM and are expected to create a block every ~1 second.

More technical and code level details of the Block Producer layer will be added in a later version of the whitepaper.

CODEO Virtual Machine

The CODEO CNETWORK uses a standard EVM based state machine, which is run by the Block Producer nodes to generate blocks. Using the EVM allows the CODEO CNETWORK to be able to build and deploy protocols such as ERC protocols as well as other protocols like Kyber CNETWORK, ZRX etc.

The beauty of the CODEO CNETWORK architecture is that since it uses an EVM-compatible state machine, it becomes very easy to port DApps and smart contracts running on the Ethereum blockchain to the CODEO CNETWORK. The CODEO Development Team intends to support generalized state transitions on the CODEO CNETWORK, and this architecture provides a smooth foundation to build upon.

CODEO Withdrawal Bridge

When an address on the CODEO CNETWORK submits a withdrawal request to the CNETWORK, the corresponding tokens are burnt (withdrawn from) on the CODEO chain and this transaction is pushed on to the CODEO chain. After the specified checkpoint interval, the PoS checkpoint layer will publish the checkpoint to the main chain, which will include the proof of burn (withdrawal) of these tokens on the CODEO chain. Once this checkpoint is committed on the mainchain, the user can claim their withdrawn tokens.

Spam Protection

The Block Producers running the block producer layer of the CODEO CNETWORK will watch the transfer state of the assets to identify frivolous transactions. They reject any incoming transactions with zero amount in payments thereby foiling any DoS/spam attacks with zero cost transactions. Even if the CODEO tokens are very low in cost and the fees being very low, due to the high TPS of CODEO CNETWORK, it would not be economically viable to run sustained DoS attacks on the CODEO CNETWORK.

The CODEO CNETWORK maintains payment transfer event logs in a UTXO-like data structure, which allows for efficient verification of inputs and outputs. This allows for a variety of security measures.

Additional checks are run to mitigate spam based on this:

- For each input, the referenced output must exist and cannot already be spent
- Check if the sum of input values is less than sum of output values.
- Check if transaction fee is too low.
- Check for duplicate transactions with same outputs in the transaction pool.
- Check for duplicate transactions with same transaction fee in the pool.

Potential Use Cases

CODEO CNETWORK Pte. Ltd. (The Governing body) is committed to provide a scalable and user-friendly ecosystem for third party Decentralized applications to thrive on. The governing body, like Ethereum and other platform foundations, will promote various Base chain DApps (like DApps built on Ethereum currently, and NEO, EOS in future) to build and migrate their user facing applications / transactions on the CODEO CNETWORK. It will also award grants and funding to third party app developers to build various use cases on top of the CODEO CNETWORK like:

Payments

The CODEO CNETWORK will provide an interface for users, payment APIs and SDKs for DApps, merchant and users to instantly accept or pay in crypto assets (e.g., ERC20 tokens, Ethers, ERC721 tokens).

The CODEO Development Team has plans to roll-out this system in three phases:

1. Ether and ERC20 token payments
2. Multi-asset cross chain transfer and payment through atomic swaps and liquidity providers
3. Fiat enabled off-ramp payment system integration through fiat liquidity providers

Atomic Swaps

CODEO contract allows users to pay with any crypto token they prefer, and receiver will receive payment in assets they prefer. The CODEO CNETWORK can handle conversation through atomic swaps between cross-chain crypto assets.

Liquidity providers

Third parties can use the CODEO CNETWORK to exchange any tokens for other tokens by everaging 0x liquidity pool or other liquidity providers while transferring crypto assets. In the case of fiat, the CODEO Development Team is planning to collaborate with fiat liquidity providers in currencies of major countries.

Lending & Credit Scoring Platform

The CODEO CNETWORK will enable platforms for merchants to assess the creditworthiness of connected users via their transaction history. This enables merchants to lend tokens to users on the CNETWORK when transacting with users that do not have sufficient funds. The CODEO CNETWORK expects to use the Dharma protocol to provide tokenized debt to all users.

Identity

Users need a utilitarian yet user-friendly interface where MetaMask or web3 enabled browsers DAPP need a way to sign transactions, but that must happen without submitting private keys on each DApp on web browsers or mobile apps. The CODEO Development Team believes that users must have control over their private keys without worrying about the security. The CODEO CNETWORK will solve that with an Open-Identity system and will deliver a seamless experience to users.

This system will also provide a way to auto-approve certain kind of transactions depending upon the criteria chosen by the users. This will drive the recurring payments on the CODEO CNETWORK.

Games

We expect games to be a big part of the CODEO CNETWORK. In-game assets represented as NFTs (ERC721) are expected to be bought, sold and traded in huge numbers on our sidechains. Developers will also be able to save game state on the sidechains, if they choose to. Along with the NFT marketplace that we will enable, developers and users will truly have a fast, efficient and secure sidechain to build and play games on.

Infrastructure

The CODEO Development Team will act on the simple mantra - make it simple and seamless. For that, the team will provide new infrastructure around the CODEO CNETWORK including user-friendly wallets for individual users and merchants, payroll dashboards, payment SDKs and other open source tools.

CODEO Wallet

The CODEO development team is working on building an easy-to-use Plasma wallet mobile app, integrated with WalletConnect, to ensure secure storage of keys, intuitive access to the features provided by the CODEO CNETWORK, as well as a seamless mechanism to connect browser-based DApps to the mobile app. Users can interact with DApps on browsers and in the future many more devices, while still keeping their keys secure in their mobile wallet.

The CODEO wallet will act as a ready tool for DApp developers to get their users onboarded and working with CODEO sidechains quickly and efficiently.

CODEO Tokens

Codeo tokens function as utility tokens and are part of the CODEO ecosystem and part of the world of decentralized digital asset trading where CODEO TOKEN as a digital asset is published using Ethereum ERC 20 technology

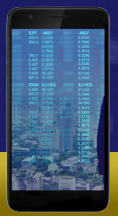
CODEO TOKEN is designed as a utility token and is used as a unit of payment between fellow users and platforms that are part of the codeo ecosystem, CODEO TOKEN is published by FIVE ANGELS INVESTMENT Limited BVI (British Virgin island).

CODEO Tokens are expected to provide the economic incentives to encourage participants to contribute and maintain the ecosystem on the CODEO CNETWORK. Computational resources are required for performing various functions on the CODEO CNETWORK such as validating blocks and publishing proofs, thus providers of these services / resources would be rewarded with CODEO tokens for providing these resources to the CNETWORK (i.e. "mining" on the CODEO CNETWORK) to maintain CNETWORK integrity. CODEO Token will be used as the unit of exchange to quantify and pay the costs of the consumed computational resources. CODEO Token is an integral and indispensable part of the CODEO CNETWORK, because without the CODEO Token, there would be no incentive for users to expend resources to participate in activities or provide services for the benefit of the entire ecosystem on the CODEO CNETWORK. Only users which have actually contributed to CNETWORK maintenance would receive token incentives. Users of the CODEO CNETWORK and/or holders of CODEO Token which did not actively participate will not receive any CODEO Token as rewards.

In order to participate in the consensus process on the CODEO CNETWORK, users would be required to stake CODEO Token as an indication of that user's commitment to the process. CODEO Token would thus also be used as a deterrent for punishing stakers for various offences (e.g. invalid blocks, illegally verifying blocks, or invalid transaction execution) by requiring them to first put up a stake of CODEO Token before being entitled to participate in the ecosystem. CODEO Token would be deducted in the event that an offence was committed by a staker.

In particular, it is highlighted that CODEO Token:

1. Is non-refundable and cannot be exchanged for cash (or its equivalent value in any other virtual currency) or any payment obligation by the Governing body, the Issuer or any affiliate;
2. Does not represent or confer on the token holder any right of any form with respect to the Governing body, the Issuer (or any of its affiliates), or its revenues or assets, including without imitation any right to receive future dividends, revenue, shares, ownership right or stake, share or security, any voting, distribution, redemption, liquidation, proprietary (including all forms of intellectual property or licence rights), or other financial or legal rights or equivalent rights, or ntellectual property rights or any other form of participation in or relating to the CODEO CNETWORK, the Governing body, the Issuer and/or their service providers
3. Is not intended to represent any rights under a contract for differences or under any other contract the purpose or pretended purpose of which is to secure a profit or avoid a loss;



4. is not intended to be a representation of money (including electronic money), security, co modity, bond, debt instrument or any other kind of financial instrument or investment;
5. is not a loan to the Governing body, the Issuer or any of its affiliates, is not intended to repr sent a debt owed by the Governing body, the Issuer or any of its affiliates, and there is no expectation of profit; and
6. does not provide the token holder with any ownership or other interest in the Governing body, the Issuer or any of its affiliates.

The contributions in the token sale will be held by the Issuer(or its affiliate) after the token sale, and contributors will have no economic or legal right over or beneficial interest in these contributions or the assets of that entity after the token sale. To the extent a secondary market or exchange for trading CODEO Token does develop, it would be run and operated wholly independently of the Governing body, the Issuer, the sale of CODEO Token and the CODEO NETWORK. Neither the Governing body nor the Issuer will create such secondary markets nor will either entity act as an exchange for CODEO Token.

Features on our development roadmap

The CODEO Development team expects to conduct various additional research based on topics proposed by the community, including but not limited to:

1. Generalized state scaling and fraud proofs/cryptographic mechanisms for the same.
2. Evaluate the approach to expand Staker base in the checkpointing layer with the future
3. Threshold based signatures implementations on Ethereum, if any.
4. Robust structure and design pattern for upgradeable smart contracts.
5. Context specific Ether less accounts and Gas Relay Abstractions on Identity
6. Privacy-enabled transactions
7. Blockchain interoperability
8. State channels on top of the sidechain

MILESTONE

FEB - APR 2019

Idea & Creations

AUG - DEC 2019

Develop CODEO Dapp
Token & IEO on CATEX
Developing CODEO Wallet

2020

JAN - Listing CODEO TOKEN on CATEX
FEB - Listing CODEO TOKEN on SATOEXCHANGES
MAR - Start IEO Phase 2 on BINANCE and IDAX
APR - Start develop for ARCHIDAX

2021

JAN - APR - Develop CODEOPAY
APR - MAY - Develop CODEO Lending Platform
JUN - Release ARCHIDAX EXCHANGES web
SEP - Release ARCHIDAX EXCHANGES mobile

2022

JAN - MAR - Listing on 10 more Exchanges and minimum 15 coinswap services

2022

APR - SEP - Develop ARCHIPRO
SEP - Release ARCHIPRO

2022

Running & Combine Conventional Business with Blockchain (Fully Operation)

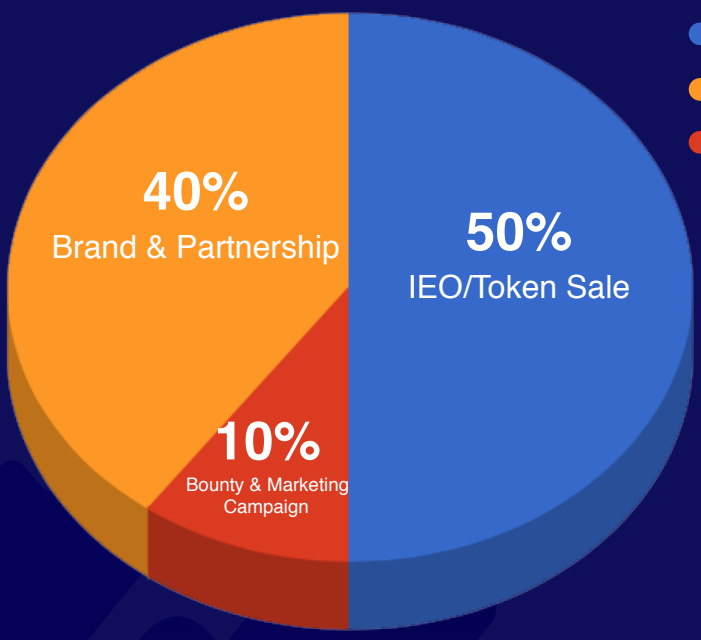
Token Details

TOKEN NAME	CODEO TOKEN
PLATFORM	ETHERIUM ERC20
TOKEN CODE	CODEO
TOTAL SUPPLY	1 TRILLION CODEO
SMART CONTRACT	0x46b4a7d906F1A943b7744Df23625E63726d79035
DECIMAL	18
BLOCK EXPLORER	https://etherscan.io/token/0x46b4a7d906F1A943b7744Df23625E63726d79035
INITIAL SUPPLY	300.070.250 CODEO

Total Token Distributions

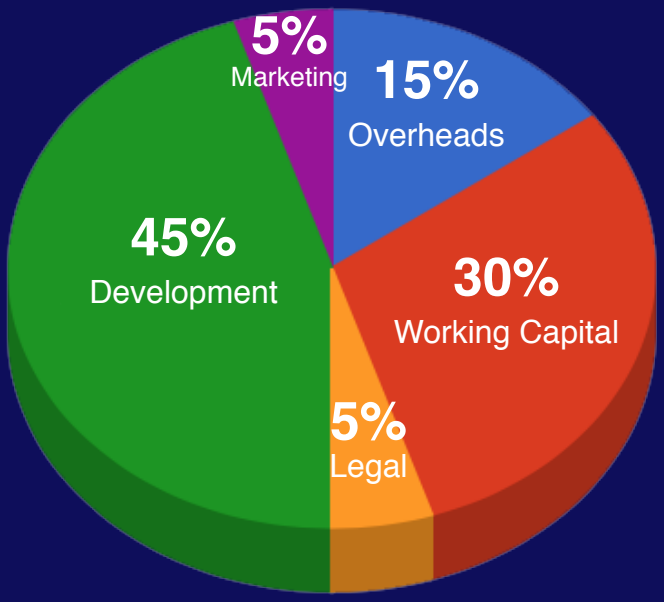
Total Supply : 1.000.000.000.000 CODEO

Initial Supply : 300.070.250 CODEO (0.030%)



- IEO/Token Sale 50% (150.035.125)
- Brand & Partnership 40% (120.028.100)
- Bounty & Marketing Campaign 10% (30.007.025)

IEO Distributions Plan



- 45% = Development
- 15% = Overheads
- 30% = Working Capital
- 5% = Legal
- 5% = Marketing

Timeline Distributions Plan & CODEO Price Estimation

Phase 1

2019 - 2020
Initial Supply
0.30%
300.070.250 CODEO

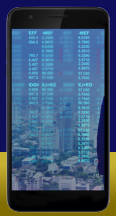
2021 - 2022
Alocations for Exchanges & Ecosystem
1%
1.000.000.000 CODEO

2022 - 2023
Distributions for Platform & Market Demands
1.5%
1.500.000.000 CODEO

2023 - 2024
Distributions for Platform & Market Demands
1.5%
1.500.000.000 CODEO

2024-2025
Distributions for Platform & Market Demands
2%
2.000.000.000 CODEO

Total Distributions Plan on Phase I = 6.300.070.250 CODEO



Phase II

Will launch start up Incubator for Funding & Development network merchant & ecosystem

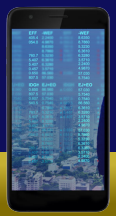
2026
Launch IEO for project incubator & funding startup
0.1%
1.000.000.000 CODEO

2026 - 2027
Alocations for adding new exchanges and distributor
0.5%
5.000.000.000 CODEO

2027 - 2029
Alocations & distributions for global user
0.5%
5.000.000.000 CODEO

2030 - 2035
Alocations for global user
0.5%
5.000.000.000 CODEO

Total Distributions Plan on Phase II = 16.000.000.000 CODEO



TOUCH WITH US

Contact & Community Group

http://www.codeotoken.com

https://twitter.com/codeotoken

https://www.facebook.com/codeotoken/

https://etherscan.io/token/0x46b4a7d906F1A943b7744Df23625E63726d79035

https://t.me/joinchat/MHIV6hcPQhGqNTQN6k4Wug

support@codeotoken.com / busdev@codeotoken.com

Announcement & Article

Medium : https://medium.com/@codeotoken

Cryptointalk.com : https://cryptointalk.com/threads/ann-ieo-codeo-token-the-new-world-digital-asset.14910/

Media Publishing

Coingecko : https://www.coingecko.com/en/coins/codeo-token

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Market Watch

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CMC'IO by Azbit
COINCOST
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